the greater length of the *basis cranii.* It may not be premature therefore to say that the species *homo sapiens* is divided into three sub-species as follows:

Microdont subspecies.
Mesodont subspecies.
Megadont subspecies.

We may then reserve the term *race* for those actual grand divisions of humanity, twelve or fifteen or more, as the case may be, resulting from the crossing of these sub-species.

MICROSCOPY.[1]

THE USES OF COLLODION.—In modern histological technique collodion has come to serve a variety of important purposes. Duval[2] was the first to call attention to its advantages as an imbedding mass. He found that it penetrated preparations easily and thoroughly; that it could be quickly brought to the proper degree of hardness in alcohol of 36° (80 %); that objects thus imbedded could be preserved in this alcohol for an indefinite length of time; that the imbedding mass preserved its transparency, so that the preparation could be easily examined; that the sections did not require to be freed from the mass, since they could be colored and mounted in glycerine, and the mass remain unaffected by the process.

As soon as Duval's discovery became known, Merkel and Schiefferdecker[3] began to experiment with collodion, and greatly improved and extended its use.

It was found desirable first of all to be able to vary the concentration of the collodion, an end very conveniently reached by Merkel through the use of a solid preparation, called *celloidin,* which he dissolved in absolute alcohol and ether in equal parts.

Duval mounted sections of objects imbedded in collodion in glycerine, and was unsuccessful in his experiments with balsam. Schiefferdecker has shown that by dehydrating the sections with 95 per cent alcohol, and clarifying in oil origanum or oil of bergamot, the sections could be mounted in balsam ("Microscopy," Aug., 1884, p. 843).

Some improvements of minor importance in the process of imbedding have been made by Thoma, Blochmann and others.

The importance of collodion in microtomy was much increased by the discovery that in combination with clove oil it could be used as a fixative for serial sections, and that the latter could be colored *after* they had been arranged and fixed on the slide. This invaluable method, discovered by Schällibaum,[4] presents all

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoology, Cambridge, Mass.
[2] Journ. de l'anat. et de la physiol., XV, p. 185, 1879.
[3] Arch. f. Anat. u. Physiol., Anat. Abth., p. 199, 1882.
[4] Arch. f. mik. Anat., XXII, p. 689, 1883.

the advantages of the shellac method of Giesbrecht, and offers, at the same time, the best means of meeting the difficulties of staining objects in toto. The only other fixative thus far known which claims to accomplish similar results is that introduced by Mayer ("Microscopy," Feb., 1884).

Prof. Gage,[1] who began to experiment with collodion as a fixative prior to the publication of Schällibaum's method, has given some valuable directions respecting its preparation and application. Gage applies the collodion and clove oil separately, first coating a number of slides with collodion, which is poured on to one end of the slide and allowed to flow quickly over it and off into the bottle; and then, at the time of using, adding a wash of clove oil. In order to remove any cloudiness that may arise in the collodion film, a little clove oil is added to the balsam.

The use of collodion to prevent the crumbling of brittle sections originated with Norman N. Mason.[2] The same method was employed in Semper's laboratory by Timm,[3] Will,[4] Sarasin,[5] Sharp and others; and Mark has found it indispensable in sectioning the ova of Lepidosteus. Mason applied the collodion by means of a fine brush, taking up a small drop and placing it "in the center of the object so as to allow it to flow out on all sides to prevent the formation of air bubbles. After being allowed to harden a minute, the section may be cut and placed on the slide *with the film of collodion underneath.*"

Mark and others who have used collodion for the same purpose, simply paint the cut surface of the object with a thin film a few seconds before making each section.

Celloidin Injections.—In the formation of injection masses collodion plays still another important role, for the discovery of which we are indebted to Schiefferdecker.[6] It can be made to penetrate easily very fine blood-vessels, and its viscosity protects them against injury; its application is simple and easy, and in all these respects it is said to be superior to the masses hitherto employed for "corrosion preparations." It has a slight shrinkage, but not enough to form a serious drawback. It is prepared in different ways according to the color to be given to the injection.

A. Asphalt Celloidin Injection.—1. Pulverized asphalt placed in a well closed bottle of ether and allowed to remain twenty-four hours, during which the mixture must be several times shaken.

2. The brown-colored ether is turned off, and small pieces of celloidin dissolved in it until the solution flows like a thick oil.[7]

[1] The Medical Student, p. 14, November, 1883.
[2] AMERICAN NATURALIST, 1880, p. 825.
[3] Semper's Arbeiten, VI, p. 110, 1883.
[4] Semper's Arbeiten, VI, p. 7, 1883.
[5] Semper's Arbeiten, VI, 1883.
[6] l. c., p. 201.
[7] The pulverized asphalt can be used many times over for coloring the ether, as very little of it will dissolve in twenty-four hours.

B. Vesuvian Celloidin Injection.—1. Make a saturated solution of Vesuvian in absolute alcohol.

2. Dissolve in this pieces of celloidin until the desired consistency is reached. The brown injection thus obtained is less satisfactory than that formed from asphalt, as its color fades somewhat.

C. Opaque Celloidin Injections.—1. Dissolve celloidin in absolute alcohol and ether in equal parts.

2. Add vermilion or Prussian blue to color.

The coloring substance should be mixed with a small quantity of absolute alcohol and then reduced to great fineness by continued trituration in a mortar. To the thick paste-like mass thus obtained the solution of celloidin is next added. The amount of coloring substance should be as little as possible, as the mass will otherwise be too brittle. If a fine injection is required the mass should be filtered through flannel moistened with ether. The syringe employed must be entirely free from fatty substances, as these render the injection mass brittle. If the piston does not fit the syringe tube sufficiently closely, it may be wound with a little gauze. The cannula should be filled with ether before it is inserted and tied in place, and again filled just before it is joined to the syringe.

In using a mass dissolved in alcohol and ether it is well to add a little ether, which will spread over the surface and thus prevent the formation of a film. The injection should be made moderately quick, as the mass stiffens soon after contact with the tissues. After injection the syringe and cannula should be cleansed with ether.

The injected organ is placed in hydrochloric acid, diluted more or less according to the danger of shrinkage. It is left in the acid, which is occasionally renewed, until the tissues are sufficiently corroded to be easily washed away by a slow and steady stream of water, conducted through rubber tubing connected with a water-pipe. The preparation may then be left in water for some days or weeks in order to free it from remaining fragments of tissue by gradual maceration. The preparation when finished, may be preserved either in glycerine or a mixture of glycerine, alcohol and water in equal parts.

The asphalt-celloidin mass is the one most highly recommended by Schiefferdecker.—*C. O. Whitman.*

NOTES ON SECTION CUTTING.—My only apology for the present communication is the hope that it may prove a saving of time to those who have encountered the difficulties of cutting eggs which are composed largely of yolk corpuscles liable to crumble in the ordinary paraffine method. The difficulty I have experienced lies not alone in the impossiblity of making sections—even from eggs very thoroughly permeated by the paraffine—which

will not crumble during the removal to the prepared slide, but also in the fact that sections successfully transferred to the slide are liable to have portions of the yolk granules loosened and floated over other portions of the sections during the removal of the paraffine. While by the ordinary methods of mounting (Geisbrecht, Schällibaum) those elements of the section which lie on its *under* side, and therefore come in immediate contact with the fixative, are safely held in place, it may happen that many from the *upper* surface are loosened and washed away, because the fixative does not penetrate the whole thickness of the section.

This obstacle may be entirely avoided by the proper use of collodion.

We are indebted to Mason,[1] so far as I am aware, for the first suggestion of the use of collodion in this connection. But the method employed by Mason has serious objections. A *drop* of collodion on the surface of a paraffine-imbedded preparation softens the object to such an extent that cutting is a very slow process, and thin sections are not easily attainable. The thickness of the collodion film, moreover, interferes more or less with accurate study of the mounted object, even if the sections are inverted when applied to the slide. The gradual drying of the surface of the film also causes the section to roll into a hollow cylinder with its collodion surface innermost, so that the inversion of the section becomes difficult if not altogether impossible. The consistency of the collodion to be used is stated by Mason, but this is of little value since even a short exposure to the atmosphere often repeated will quickly change the condition of the collodion in the bottle.

All these impediments—but for which the method, I believe, would have come into more general use—may be largely if not entirely obviated by using *a very small amount of a rather thin collodion.*

The criterion which serves me is: *the collodion must dry almost instantly* (within two or three seconds after being applied) *without leaving a trace of glossiness on the surface of the paraffine.*[2]

In this collodion process I use at present the following method:

The object imbedded in paraffine in the ordinary way is placed in a receiver of a Thoma's microtome and the paraffine cut away to within 1^{mm} to 2^{mm} of the object on four sides,

[1] N. N. Mason, Use of Colloidion in Cutting thin Sections of Soft Tissues. AMER. NAT., Vol. XIV, p. 825, Nov., 1880.

[2] Judging from the effects, I am inclined to think that by this method the collodion penetrates the preparation to a certain depth, fixing the parts in their natural relations without producing a superficial film. At any rate, if the sections are made sufficiently thin (e. g. 5μ) there is no curling, whereas with much thicker sections, the superficial portion of which alone contains in that case the collodion, there is often a tendency to roll. This I have attributed to the slight shrinkage in the upper or collodion-impregnated portion of the section.

leaving a rectangular surface of paraffine, two edges of which are parallel to the edge of the knife.

A slide prepared by being painted with *a thin coat* of Schällibaum's mixture of collodion and clove oil is placed at the left of the microtome.

At the right of the latter, handy to the right hand, is a small bottle half full of the thin collodion, into which dips the tip of a camel's hair brush; the quill of the brush is thrust through a hole in a thin flat cork which serves at once as a temporary cover to the bottle and a support to the brush, the latter being adjusted to any height of the collodion by simply shoving it up or down through the hole in the close-fitting cork. Near by is a small bottle of *ether* with which the collodion is thinned as soon as it begins to leave a shining surface on the paraffine.

The operator should sit *facing the light*, so that he may judge accurately of the condition of the surface of the paraffine, which reflects the light. Everything being in readiness the brush is lifted and wiped on the mouth of the bottle to *remove the most of the collodion*, and then the paraffine and object are *at once* painted by *quickly drawing the brush across the surface*, care being used that it is evenly applied and that the collodion is not carried on to the vertical faces of the block. The temporary moistening vanishes like a cloud from the surface of the paraffine, the brush is returned to the bottle at once; the knife is drawn and returned, leaving the section on the edge of the blade. The object in the block is then painted again, but before drawing the knife a second time the first section is removed with a scalpel and placed on the slide with its *upper face in contact with the fixative*. Then the knife is drawn again, and the other steps of the process repeated. Thus the collodion has time to thoroughly dry before the section is made. But if the precautions above given are observed, it will not be necessary to wait for the drying of the collodion and the section may therefore be cut at once, *i. e.*, within five seconds after painting. It is thus possible to cut as fast as one can paint the surface, and with some practice it becomes possible to cut *continuous ribbons* of sections which may be transferred at intervals. Practically I find it most convenient to cut enough to form one row or half a row of sections at a time and transfer at once to the slide, rather than to cut the whole object without interruption as is done in the ordinary method.

The following precautions may prove serviceable: Especial care should be exercised to prevent the painting of the vertical face nearest the operator, since the section is then liable to cling along its whole edge to this vertical film and be carried *under* the knife blade. If by chance this should occur, the section should be removed from the block *before the knife is shoved back*, as it is liable to be caught and lacerated between the face of the block and the under surface of the returning blade. The possibility of

the section being thrown under the knife blade, may, however, be obviated either by carefully trimming the vertical face in case it is accidentally painted (to allow for which the *hither margin* of the paraffine may be left broader than the other three), or by drawing the knife *slowly*, so that the first indication of a failure to cut through the vertical film may be recognized and the section held in place on the blade by a slight pressure with a soft brush, whereupon the knife will cut through the film and leave the section free.

If by chance the paraffine block has been painted with too much collodion or with collodion which is too concentrated, thus leaving a shiny surface, the film should be at once broken by pressing it gently two or three times in quick succession with the end of a rather stiff, blunt, *dry* brush. This enables the collodion to dry quickly and thus prevents the softening of the paraffine.

If the sections have a tendency to curl they may be flattened out on the slide by means of a brush, for a section thus impregnated with collodion may be handled during the first few seconds after contact with the Schällibaum mixture with much greater impunity than one not so treated. If the collodion has been too much thinned with ether, the fact will become apparent from the softening of the paraffine, and may be remedied by waiting for the evaporation of the ether, or by adding thicker collodion.

This process can be in no way considered as a substitute for the ordinary method of cutting objects since it requires more time and closer attention to details, but for those cases where there is a liability to crumbling, or where sections of sufficient thinness cannot be procured free from folds, it will doubtless be found very serviceable.—*E. L. Mark, Mus. Comp. Zoöl., Cambridge, Jan., 1885.*

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SCIENTIFIC NEWS.

— At a late meeting of the Liverpool Microscopical Society, Mr. A. Norman Tate read a paper, which is reported in the *English Mechanic*, on the microscopical examination of potable water. After alluding to the impossibility of always determining by chemical means alone whether a water is or is not fit for dietetic purposes, he proceeded to speak of the importance of microscopical investigation in relation to water-supply, pointing out that it afforded better opportunity of determining the character of organic impurities, and that it might frequently assist in ascertaining the character of the mineral constituents. He considered the arbitrary standards of purity as regards organic constituents, set up by some water analysts as being unsafe to use, without knowing the exact nature of such matters. And in deciding this the microscope could help. He then proceeded to speak of in-